FUEL ADDITIVE DISPENSATION METHOD AND APPARATUS

Technical Field

This invention relates generally to fuel additives and to the dispensation of fuel additives to an end user.

Background

Liquid fuels of various kinds are known in the art. In general such fuels serve to provide a desired form of energy when consumed in some controlled fashion (such as, for example, during combustion). Many liquid fuels, however, can provide better overall performance and/or serve one or more additional purposes when used in conjunction with one or more fuel additives. Various fuel additives are known in the art and include generally additives that improve such things as combustibility, storage characteristics, resultant characteristic emissions, and so forth. Some fuel additives serve in many ways to improve the performance, efficiency, or longevity of many engines when used properly and can even aid in accommodating or even offsetting the effects of engine age, duty cycle, frequency of usage, and so forth.

In large measure, the use of many fuel additives is presently determined by legislative fiat and/or by the fuel supplier. An end user will typically have little choice with respect to what additives are provided with a given liquid fuel. Furthermore, in most cases, the end user will often be significantly challenged to ascertain the specific additives that are included, or excluded, in a given liquid fuel as dispensed from a given liquid fuel dispensing station. As a result, most

end users are likely relatively ignorant about fuel additives in general and/or what fuel additives, if any, may be present in a given liquid fuel as dispensed at a given fuel dispensing station.

Some fuel additives are available as an after-market product. Knowledgeable end users who can obtain a particular desired fuel additive are then able to personally add the selected fuel additive to a liquid fuel after dispensation of that fuel by the fuel supplier. Such an approach, while satisfactory to a limited extent, leaves much to be desired. The desired additive may not be conveniently available when required. Furthermore, even a knowledgeable end user may face difficulties in adding an appropriate quantity of the selected fuel additive to a recently dispensed quantity of fuel. As a result, even when available and even when used by a knowledgeable end user, present fuel additive paradigms can often lead to a misapplication and/or misuse of the additive or additives of choice.

Brief Description of the Drawings

The above needs are at least partially met through provision of the fuel additive dispensation method and apparatus described in the following detailed description, particularly when studied in conjunction with the drawings, wherein:

FIG. 1 comprises a flow diagram as configured in accordance with various embodiments of the invention;

FIG. 2 comprises a block diagram as configured in accordance with various embodiments of the invention;

FIG. 3 comprises a detail schematic representation as configured in accordance with an embodiment of the invention;

FIG. 4 comprises a schematic depiction as configured in accordance with an embodiment of the invention; and

FIG. 5 comprises a schematic depiction as configured in accordance with various embodiments of the invention.

Skilled artisans will appreciate that elements in the figures are illustrated for simplicity and clarity and have not necessarily been drawn to scale. For example, the dimensions of some of the elements in the figures may be exaggerated relative to other elements to help to improve understanding of various embodiments of the present invention. Also, common but well-understood elements that are useful or necessary in a commercially feasible embodiment are typically not depicted in order to facilitate a less obstructed view of these various embodiments of the present invention.

Detailed Description

Generally speaking, pursuant to these various embodiments, an end user can be provided with an opportunity at an end-user liquid fuel dispenser to select at least one fuel additive to be added to a liquid fuel upon dispensation of that fuel to the end user. In a preferred embodiment the selected fuel additive (or additives) is automatically combined with the liquid fuel in conjunction with such dispensation.

Pursuant to one embodiment, a plurality of fuel additives are available for selection by the end user. The end user will preferably be able to select none, one, or more than one of the available fuel additives for combination with the liquid fuel. Pursuant to a preferred approach, there will also be a plurality of liquid fuels to choose from (for example, gasoline formulations

having different octane content). The end user will then have the opportunity to select both a given liquid fuel from amongst a plurality of fuel candidates and one or more fuel additives from amongst a plurality of fuel additive candidates.

So configured, an end user can select specific fuel additives to suit the end user's unique needs and requirements. For example, fuel additives that are particularly suited to meet the needs of a particular engine (taking into account, for example, various relevant parameters such as engine type and/or age) can be selected by an end user without requiring a special (likely costly) custom formulation from the fuel supplier. Other benefits will become more evident upon making a thorough review and study of the following detailed description.

Referring now to FIG. 1, an exemplary process 10 can be based upon, or can optionally include, the provision of a liquid fuel 11, at least one fuel additive 12, and a fuel additive selection interface 13. The liquid fuel can comprise any liquid fuel including, but not limited to, gasoline, diesel fuel, bio-diesel fuel, kerosene, propane, hydrogen, butane, and so forth. And, as will be shown below in more detail, more than one liquid fuel can be provided as may best suit the needs of a given situation. In a similar fashion, virtually any fuel additive can be provided as well. A non-exhaustive but exemplary listing might include any of:

- an antioxidant;
- a dispersant;
- a cetane improver;
- a combustion improver;
- a detergent;
- a fuel-borne catalyst;

- a catalyst protector;
- a catalytic converter poison scavenger;
- a friction modifier;
- a lubricity additive;
- an octane improver;
- a colorant;
- a marker;
- an identifying odor; and/or
- a mixture of any of any two or more of the above.

Specific examples of potentially useful fuel additives can include but are not limited to organic nitrates, such as 2-ethyl hexyl nitrate, manganese-containing compounds, such as methylcyclopentadienyl manganese tricarbonyl, available as MMT® Performance Additive from Ethyl Corporation, esters, amides, amines and carboxylic acids useful as fuel lubricity additives such as HiTEC® 4848A available from Ethyl Corporation, and Paraflow and Paradyne available from Infineum USA LP, Flozol and Lubrizol-brand Fuel Additives available from Lubrizol Corporation, PURADD and ZEREX available from BASF, Winter Thaw and Nalfleet available from Ondeo Nalco, YF Special and Yellow Winter and WP 50 and VO12 and TT and Sure-flo and Spec-Aid available from GE BETZ, gasoline and diesel fuel additives available from Octel Starreon LLC, AFS 106 PPD and HT 4130 and SDA 5000 and WDA 1000 Plus and Altra available from Allegheny Petroleum Products Company, fuel additives available from ELF Aquitane, and OGA available from Chevron Oronite, and Slick 50 from Pennzoil Quaker State, and detergent packages such as HiTEC® 6423 and HiTEC® 6423 N available from Ethyl

Corporation, and SAP available from Infineum USA LP. Other known fuel additives useful in the present invention are included on the Environmental Protection Agency's list of fuel additives found on their website at http://www.epa.gov/otaq/regs/fuels/additive/web-addt.txt, all of which are incorporated herein by reference as if fully recited herein.

As will be exemplified in more detail below, the fuel additive selection interface serves, as a usual minimum, to provide a mechanism whereby an end user can select to add a given fuel additive to the dispensation of the liquid fuel. As appropriate, such an interface can further serve to permit the end user to select one or more fuel additives from amongst a plurality of available fuel additives and/or to otherwise select, control, or influence other characteristics or attributes of the fuel additive dispensation process (such as, for example, influencing not only the selection of a particular fuel additive but the proportion by which such fuel additive will be combined with the liquid fuel upon dispensation).

Pursuant to a preferred embodiment, upon receiving 14 an end user fuel additive selection (via, for example, the fuel additive selection interface) and further upon receiving 15 instructions from the end user regarding dispensation of the liquid fuel itself, the process 10 then dispenses 16 the liquid fuel as automatically combined with the selected fuel additive or additives. As will be shown in more detail below, there are various ways by which such combining can be realized to suit a wide variety of operating conditions and circumstances. It should also be understood that this process 10 will preferably accommodate a selection by the end user of no fuel additives. When this occurs, the process 10 will facilitate dispensing the liquid fuel sans any selectable fuel additives (it is also possible, of course, that the liquid fuel may already include or require combining with some non-selective fuel additives as may be required by law or otherwise).

Referring now to FIG. 2, an end-user fuel dispensing station 20 can be configured in a preferred embodiment to operate in conjunction with a supply of at least a first liquid fuel 21. In many settings (such as a gasoline service station for automobiles and trucks), of course, many differing fuels may be available. To match this circumstance the fuel dispensing station 20 will also likely frequently be configured to operate in conjunction with additional supplies of liquid fuel 22 (for example, a plurality of gasoline supplies wherein the supplies differ from one another with respect to their respective octane ratings). When a plurality of liquid fuel supplies are provided, it may also be preferred to provide a fuel selector 23 that operably couples to the differing supplies of liquid fuel to permit an end user to select a particular one of the liquid fuels for dispensing. Such fuel selectors 23 are well understood in the art and therefore additional details regarding such a selector will not be provided here for the sake of brevity.

A preferred end-user fuel dispensing station 20 will also be configured to operate in conjunction with at least a supply of a first fuel additive 24. In one embodiment, additional fuel additive supplies 25 may also be present to offer a variety of fuel additive opportunities that differ from one another (for example, such fuel additives may differ from one another with respect to their chemical content or their proportional chemical content). In particular, the end-user fuel dispensing station 20 will preferably include a fuel additive selector 26 that permits an end user to select the fuel additive 24 (or one or more of the fuel additives when a plurality of fuel additive supplies are available) to be combined with the dispensing of their selected liquid fuel. Such a fuel additive selector 26 can be fully or partially discrete with respect to any fuel selector 23 as may also be present or, if desired, can be integrated 27 fully or partially therewith. Such integration may better suit desired or required economies with respect to design and

manufacture, performance capabilities, security concerns, accounting and billing functionality and so forth. On the other hand, a discrete architecture may better suit the needs of many applications including, for example, retrofitting applications.

In general, and as noted above, this fuel additive selector 26 should preferably comprise an interface that facilitates interaction with an end user. This interface can assume any appropriate form including but not limited to a haptic interface (such as but not limited to one or more push buttons, toggle switches, rotatable devices, touch sensitive displays, keys or keypad(s), and so forth), an audio interface (such as but not limited to a speech recognizer), and/or a wireless interface (such as but not limited to a radio frequency identification tag-based interface, a radio frequency carrier-based interface, an optical carrier-based interface, an ultrasonic carrier-based interface, and so forth).

In some instances it may be desired to facilitate an automatic interfacing with an end user. For example, the end user's vehicle may be programmed to be able to identify a precise fuel and fuel additive mixture that it requires or prefers and to communicate that information via a wireless link to the fuel additive selector 26. Such a communication can be initiated as desired. Pursuant to one example the communication can be triggered by the end user by an explicit instruction or action. Pursuant to another example, the communication can be automatically and autonomously triggered. As one illustration of the latter, the end user's vehicle can be provided with a radio frequency identification tag-based mechanism that automatically transmits, when appropriately probed in accordance with well-understood prior art technique, previously recorded data such as specific fuel additives to be combined with liquid fuel as introduced into the vehicle. Such a configuration would permit a given end user to receive at least some of the

benefits of these teachings without themselves necessarily being presently cognizant of the specific fuel additive needs and requirements of their vehicle.

The interface form factor of the fuel additive selector 26 can assume any appropriate guise as appropriate to the needs of a given context. To illustrate a few such possibilities, and referring momentarily to FIG. 3, the fuel additive selector 26 can include a selection interface 31 (such as the push button illustrated in FIG. 3). In a preferred embodiment, when more than one fuel additive is available for selection (alone or in combination with other selected fuel additives), additional selection interfaces 32 can be similarly provided (such as the second push button illustrated in FIG. 3). Such interfaces can be presented, in a preferred approach, with one or more corresponding user-viewable indicia that relate to the fuel additives. For example, as illustrated, such user-viewable indicia can include a generic descriptor for the corresponding fuel additive (for example, one of the selection interfaces 31 has a first user-viewable indicia 33 comprising the word "detergent" to generically characterize the type of fuel additive that corresponds to that selection interface 31 while another of the selection interfaces 32 has a first user-viewable indicia 34 comprising the word "lubricant" to similarly generically characterize the fuel additive that corresponds to the second selection interface 34).

As another example, and as also illustrated in FIG. 3, one or more of the selection interfaces can be accompanied by a depiction of a trademark 35 or 36 such that an end user will perceive and understand that upon selection of a particular interface 31 or 32 the user will thereby be indicating selection of a fuel additive that corresponds to the depicted trademark. As yet another example (not illustrated), a single selection interface can correlate to selection of a

corresponding plurality of specific fuel additives (and again, generic descriptors and/or trademarks can be used to characterize such a pre-defined grouping of fuel additives).

In a given embodiment it may also be desirable to display other information to an end user. Such information can be displayed in either a static or dynamic fashion and can include, but is not limited to, pricing information for available fuel additives, information regarding potential or measured benefits as concerns usage of such fuel additives, cautions regarding the usage of such fuel additives (including personal health cautions, performance cautions, environmental concerns, and so forth), legal notices as correspond to given fuel additives, and recommended usage comments as corresponds to one or more of the fuel additives, to name a few. Some or all of these types of informational content can be provided in any suitable way. For example, an active display can be used at the point of dispensation (or fuel and/or fuel additive selection). As another example, a hard copy printout or other presentation of such information can be similarly presented to the end user. As yet another example, some or all of such information can be presented in an audiblized manner (either alone or in conjunction with other presentation mechanisms and approaches).

So configured, the fuel additive selector 26 serves to facilitate selection of at least one fuel additive to be automatically combined with a liquid fuel to be dispensed to an end user. In particular this selector 26 serves to facilitate such a selection by the end user themselves. Such a fuel additive selector 26 can be comprised of a fixed-purpose mechanism and/or can be comprised partially or fully or a programmable platform, with such architectural choices being well understood in the art.

In a preferred embodiment such an end-user fuel dispensing station 20 will also include a combiner 28 to effect the desired automatic combination of the selected fuel with the selected fuel additive(s). Such a combiner 28 can be configured in a variety of ways and will typically comprise a suitable conduit leading to each fuel or fuel additive supply (and/or in input that operably couples to such conduits), valves as appropriate to control the selected flow of such liquids, and an output leading to a conduit (or conduits) to facilitate the delivery of the fuel and fuel additive to the end user's fuel storage container.

In general, such a combiner can serve to combine the fuel and fuel additives prior to dispensation to the end user's fuel container and/or to effect such a combination of fuel and fuel additive within the end user's fuel container. To illustrate, and referring now to FIG. 4, the combiner 28 can serve to combine the fuel 21 (as represented by the letter "F") with a fuel additive 24 (as represented by the letter "A") as introduced by a selector-controlled valve 40 within a mixing chamber prior to dispensing the combined fuel/fuel additive mixture (as represented by the letters "FA") via an output conduit 41 to an end user's fuel container 42 (such as, for example, a gasoline tank in an automobile). Such an approach may be particularly useful when the combiner 28 and/or the fuel additive selector 26 has a real time capability to accurately monitor the quantity of fuel 21 that is flowing into the combiner 28 to thereby assure that a correct quantity of fuel additive 24 is being added thereto and combined therewith prior to admission to the end user's fuel container 42.

As will be well understood by those skilled in the art, the combiner 28 can combine these materials through turbulent action as may result through the admission and passage of such fluids into and through the combiner and/or may be partially or fully facilitated by use of one or more

mixing mechanisms (not shown) (such as, but not limited to, moving paddles, undulating surfaces, ultrasonic energy, and so forth).

As another illustration, and referring now to FIG. 5, the combiner 28 can serve instead to direct measured quantities of fuel 21 and fuel additive 24 (using, for example, corresponding fluid flow control values 52 and 51 respectively) into the end user's fuel container 42 where the actual combination of the fuel and fuel additive occurs. For example, the combiner 28 can provide a liquid fuel and first fuel additive end-user dispensing output that comprises a dual output conduit arrangement 53 and 54 where each conduit supports dispensation of a corresponding substance. Such a configuration will readily support various modes of dispensation including parallel dispensation of both (or all) fuel and fuel additive(s) as well as seriatim delivery schemes where, for example, the fuel additive is dispensed subsequent to dispensation of the fuel (which example comprises the illustration depicted in FIG. 5).

Other configurations are of course possible. For example, the combiner 28 can comprise a single output conduit wherein the combiner permits only seriatim flow of the fuel and fuel additive. This configuration would permit, for example, a given fuel additive to be delivered first into the end user's fuel container followed by dispensation of the liquid fuel.

Such elements, and indeed liquid material combiners in general, are relatively well understood in the art. And, insofar as these teachings are generally applicable to use with all or virtually all such known (and likely hereafter developed) combiner architectures, additional description will not be set forth herein for the sake of brevity and the preservation of focus.

Numerous benefits are derived through deployment and usage of such embodiments. End users are now able to obtain one or more fuel additives to more appropriately suit their

individual needs, circumstances, operating conditions, and the like. Notwithstanding such a potentially broad and generous availability of fuel additive mixes, fuel suppliers are not required to pre-mix, transport, and individually store each and every one of these mixes. Such circumstances provide particular benefit to end users who require or prefer relatively unusual mixes, and even relatively rare mixes can now be as relatively available as highly common mixes. Such a paradigm also supports potentially greater consumer choice. For example, a given end-user fuel dispensing station can offer a number of different fuel additives that are each intended to address a similar need (such as serving as an engine detergent). The end user then has the choice of selecting a desired fuel additive by, for example, acting upon brand reliance or preference.

Those skilled in the art will recognize that a wide variety of modifications, alterations, and combinations can be made with respect to the above described embodiments without departing from the spirit and scope of the invention, and that such modifications, alterations, and combinations are to be viewed as being within the ambit of the inventive concept. For example, the end-user fuel dispensing station can be provided with one or more active displays to facilitate a more dynamic presentation of information including but not limited to the available choice of fuel additives, a corresponding price for such fuel additives, the fueling and additive combination process, and so forth.